

CLAIMS

- 1 1. A method comprising:
2 receiving audio samples representing an input audio
3 signal;
4 transforming the input audio samples into a vector of
5 spectral values in a frequency domain; and
6 determining a value of a quantizing parameter that
7 satisfies one or more criteria based, at least in part, on
8 a modified Newtonian search process, the determined value
9 of the quantizing parameter being used to quantize the
10 respective vector of spectral values to generate a vector
11 of quantized values.
- 1 2. The method of claim 1 wherein determining the value of
2 the quantizing parameter includes:
3 determining the value of the quantizing parameter such
4 that a maximum quantized value does not exceed a maximum
5 index of one or more corresponding codebooks.
- 1 3. The method of claim 2 wherein the one or more
2 codebooks are used to requantize the quantized values.

1 4. The method of claim 3 wherein the one or more
2 codebooks are Huffman code tables.

1 5. The method of claim 2 wherein the value of the
2 quantizing parameter is determined according to the
3 following formula:

$$4 \quad \text{global_gain} \geq \left\lceil A \cdot \log_2 \left(\frac{\text{MAX}|x_r(i)|}{[B-C]^D} \right) \right\rceil$$

5 wherein global_gain corresponds to the value of the
6 quantizing parameter, A corresponds to a first constant,
7 $x_r(i)$ corresponds to an original spectral value for
8 frequency line i , B corresponds to a second constant
9 representing a maximum quantized spectral value, C
10 corresponds to a third constant, and D corresponds to a
11 fourth constant.

1 6. The method of claim 1 wherein determining the value of
2 the quantizing parameter includes:

3 determining the value of the quantizing parameter
4 based on the modified Newtonian search process such that a
5 total number of bits used for encoding the vector of
6 quantized values does not exceed a maximum number of bits
7 available for encoding the vector of the quantized values.

1 7. The method of claim 6 including:
2 computing a first estimate and a second estimate for
3 the quantizing parameter; and
4 performing a set of operations iteratively until a
5 predetermined number of iterations is reached, including:
6 deriving a new estimate for the quantizing
7 parameter based on the previous estimates for the
8 quantizing parameter.

1 8. The method of claim 7 wherein deriving the new
2 estimate includes:
3 calculating a line tangent to a function representing
4 the total number of bits used based on the previous
5 estimates; and
6 calculating the new estimate based on an intercept
7 between the line tangent calculated and a line representing
8 the maximum number of bits available.

1 9. The method of claim 7 wherein performing the set of
2 operations further including:
3 determining whether the total number of bits based
4 upon the new estimate exceeds the maximum number of bits
5 available;

6 if the total number of bits based upon the new
7 estimate exceeds the maximum number of bits available,
8 increasing the new estimate by a first factor; and
9 if the total number of bits based upon the new
10 estimate does not exceed the maximum number of bits
11 available, decreasing the new estimate by a second factor.

1 10. The method of claim 9 wherein the first factor and
2 second factor are integer values.

1 11. The method of claim 7 wherein the value of the
2 quantizing parameter determined with respect to one block
3 of spectral values is stored in memory and used as an
4 initial estimate for a next block of spectral values.

1 12. An apparatus comprising:
2 logic to receive input audio samples representing
3 corresponding input audio signals;
4 logic to transform the input audio samples into a
5 vector of spectral values in a frequency domain; and
6 logic to determine a value of a quantizing parameter
7 that satisfies one or more criteria based, at least in
8 part, on a modified Newtonian search process, the
9 determined value of the quantizing parameter being used to

10 quantize the respective vector of spectral values to
11 generate a vector of quantized values.

1 13. The apparatus of claim 12 wherein logic to determine
2 the value of the quantizing parameter includes:
3 logic to compute the value of the quantizing parameter
4 such that a maximum quantized value does not exceed a
5 maximum index of one or more corresponding codebooks.

1 14. The apparatus of claim 13 wherein the value of the
2 quantizing parameter is determined according to the
3 following formula:

$$4 \quad \text{global_gain} \geq \left\lceil A \cdot \log_2 \left(\frac{\text{MAX}[x_r(i)]}{[B - C]^D} \right) \right\rceil$$

5 wherein global_gain corresponds to the value of the
6 quantizing parameter, A corresponds to a first constant,
7 $x_r(i)$ corresponds to an original spectral value for
8 frequency line i , B corresponds to a second constant
9 representing a maximum quantized spectral value, C
10 corresponds to a third constant, and D corresponds to a
11 fourth constant.

1 15. The apparatus of claim 12 wherein logic to determine
2 the value of the quantizing parameter includes:

3 logic to determine the value of the quantizing
4 parameter based on the modified Newtonian search process
5 such that a total number of bits used for encoding the
6 vector of quantized values does not exceed a maximum number
7 of bits available for encoding the vector of the quantized
8 values.

1 16. The apparatus of claim 15 including:

2 logic to compute a first estimate and a second
3 estimate for the quantizing parameter; and

4 logic to perform a set of operations iteratively until
5 a predetermined number of iterations is reached, including:

6 logic to derive a new estimate for the quantizing
7 parameter based on the previous estimates for the
8 quantizing parameter.

1 17. The apparatus of claim 16 wherein logic to derive the
2 new estimate including:

3 logic to calculate a line tangent to a function
4 representing the total number of bits used based on the
5 previous estimates; and

6 logic to calculate the new estimate based on an
7 intercept between the line tangent calculated and a line
8 representing the maximum number of bits available.

1 18. The apparatus of claim 17 wherein logic to perform the
 2 set of operations further including:
 3 logic to determine whether the total number of bits
 4 based upon the new estimate exceeds the maximum number of
 5 bits available;
 6 logic to increase the new estimate by a first integer
 7 if the total number of bits based upon the new estimate
 8 exceeds the maximum number of bits available; and
 9 logic to decrease the new estimate by a second integer
 10 if the total number of bits based upon the new estimate
 11 does not exceed the maximum number of bits available.

1 19. A system comprising:
 2 a transformation unit to transform input audio samples
 3 representing corresponding audio signals into a vector of
 4 spectral values in a frequency domain;
 5 a psychoacoustic modeling unit to analyze the input
 6 audio samples and generate a frequency mask; and
 7 a bit allocator and quantizer unit coupled to the
 8 transformation unit and the psychoacoustic unit, the bit
 9 allocator and quantizer unit including:
 10 logic to determine a value of a quantizing
 11 parameter that satisfies one or more criteria based,

12 at least in part, on a modified Newtonian search
13 process, the determined value of the quantizing
14 parameter being used to quantize the respective vector
15 of spectral values to generate a vector of quantized
16 values.

1 20. The system of claim 19 wherein logic to determine the
2 value of the quantizing parameter includes:

3 logic to compute the value of the quantizing parameter
4 such that a maximum quantized value does not exceed a
5 maximum index of one or more corresponding codebooks, based
6 upon the following formula:

$$7 \quad \text{global_gain} \geq \left\lceil A \cdot \log_2 \left(\frac{\text{MAX}|x_r(i)|}{[B-C]^p} \right) \right\rceil$$

8 wherein global_gain corresponds to the value of the
9 quantizing parameter, A corresponds to a first constant,
10 $x_r(i)$ corresponds to an original spectral value for
11 frequency line i , B corresponds to a second constant
12 representing a maximum quantized spectral value, C
13 corresponds to a third constant, and D corresponds to a
14 fourth constant.

1 21. The system of claim 19 wherein logic to determine the
2 value of the quantizing parameter includes:

3 logic to determine the value of the quantizing
4 parameter based on the modified Newtonian search process
5 such that a total number of bits used for encoding the
6 vector of quantized values does not exceed a maximum number
7 of bits available for encoding the vector of the quantized
8 values.

1 22. The system of claim 21 including:

2 logic to compute a first estimate and a second
3 estimate for the quantizing parameter; and

4 logic to perform a set of operations iteratively until
5 a predetermined number of iterations is reached, including:

6 logic to derive a new estimate for the quantizing
7 parameter based on the previous estimates for the
8 quantizing parameter.

1 23. The system of claim 22 wherein logic to derive the new
2 estimate including:

3 logic to calculate a line tangent to a function
4 representing the total number of bits used based on the
5 previous estimates; and

6 logic to calculate the new estimate based on an
7 intercept between the line tangent calculated and a line
8 representing the maximum number of bits available.

1 24. The system of claim 23 wherein logic to perform the
2 set of operations further including:

3 logic to determine whether the total number of bits
4 based upon the new estimate exceeds the maximum number of
5 bits available;

6 logic to increase the new estimate by a first integer
7 if the total number of bits based upon the new estimate
8 exceeds the maximum number of bits available; and

9 logic to decrease the new estimate by a second integer
10 if the total number of bits based upon the new estimate
11 does not exceed the maximum number of bits available.

1 25. A machine-readable medium comprising instructions
2 which, when executed by a machine, cause the machine to
3 perform operations including:

4 receiving audio samples representing an input audio
5 signal;

6 transforming the input audio samples into a vector of
7 spectral values in a frequency domain; and

8 determining a value of a quantizing parameter that
9 satisfies one or more criteria based, at least in part, on
10 a modified Newtonian search process, the determined value
11 of the quantizing parameter being used to quantize the

12 respective vector of spectral values to generate a vector
13 of quantized values.

1 26. The machine-readable medium of claim 25 wherein
2 determining the value of the quantizing parameter includes:
3 determining the value of the quantizing parameter such
4 that a maximum quantized value does not exceed a maximum
5 index of one or more corresponding codebooks according to
6 the following formula:

$$7 \qquad \text{global_gain} \geq \left\lceil A \cdot \log_2 \left(\frac{\text{MAX}|x_r(i)|}{[B-C]^p} \right) \right\rceil$$

8 wherein global_gain corresponds to the value of the
9 quantizing parameter, A corresponds to a first constant,
10 $x_r(i)$ corresponds to an original spectral value for
11 frequency line i , B corresponds to a second constant
12 representing a maximum quantized spectral value, C
13 corresponds to a third constant, and D corresponds to a
14 fourth constant.

1 27. The machine-readable medium of claim 26 wherein
2 determining the value of the quantizing parameter includes:
3 determining the value of the quantizing parameter
4 based on the modified Newtonian search process such that a
5 total number of bits used for encoding the vector of

6 quantized values does not exceed a maximum number of bits
7 available for encoding the vector of the quantized values.

1 28. The machine-readable medium of claim 27 including:
2 computing a first estimate and a second estimate for
3 the quantizing parameter; and
4 performing a set of operations iteratively until a
5 predetermined number of iterations is reached, including:
6 deriving a new estimate for the quantizing
7 parameter based on the previous estimates for the
8 quantizing parameter.

1 29. The machine-readable medium of claim 28 wherein
2 deriving the new estimate includes:
3 calculating a line tangent to a function representing
4 the total number of bits used based on the previous
5 estimates; and
6 calculating the new estimate based on an intercept
7 between the line tangent calculated and a line representing
8 the maximum number of bits available.

1 30. The machine-readable medium of claim 29 wherein
2 performing the set of operations further including:

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3 determining whether the total number of bits based
4 upon the new estimate exceeds the maximum number of bits
5 available;
6 if the total number of bits based upon the new
7 estimate exceeds the maximum number of bits available,
8 increasing the new estimate by a first factor; and
9 if the total number of bits based upon the new
10 estimate does not exceed the maximum number of bits
11 available, decreasing the new estimate by a second factor.